

Dimensions (of largest specimen, contracted).—Height, 17 mm. : diameter of column, 4 mm. ; diameter of disc, 6 mm.

Body-wall.—The wall is thin, the mesogloea occupying the greater part, and sending strands across the ectoderm. The ectoderm is almost obliterated by the great mass of sandy encrustation. The usual cell-islets and lacunae are present in the mesogloea, but I found no sign of an encircling sinus.

Mesenteries.—The imperfect mesenteries are very short. I was unable from my sections to ascertain the exact number of mesenteries, owing to reasons already stated.

Tentacles.—The tentacles were all infolded, and their number and arrangement could not be ascertained.

Sphincter Muscle.—Traces of a mesogloea sphincter were found.

Metridium canum n. sp.

The collector's description is: "Greyish. Abundant on the under-side of stones near low-water mark, Coral Bay, Sunday Island. This species . . . tolerates a muddy or sandy bottom."

Pedal Disc.—Adherent, rather wider than the column.

Column.—Cylindrical. Longitudinally wrinkled in contraction. Cinclides are present on the upper part of the column.

Tentacles.—About 200 in number, crowded and arranged in four, or perhaps five, cycles. In some of the preserved specimens the tentacles have black tips.

Body-wall.—The usual hexactinian features are observable. The mesogloea is comparatively thick, though variable in different portions of transverse sections. It appears fibrillar in structure, and contains numerous collections of cells.

Sphincter.—A weak mesogloea sphincter is present.

Mesenteries.—There are four cycles, 45 pairs in all. Of these, only the primaries, 6 pairs in number, are perfect.

Dimensions (of largest specimen, contracted).—Height, 9 mm. ; diameter of column, 10 mm. ; diameter of disc, 15 mm.

ART. XXIV.—*Notes on a Collection of Cephalopods from the Kermadec Islands.*

By S. S. BERRY, Redlands, California.*

Communicated by W. R. B. Oliver.

[Read before the Auckland Institute, 3rd December, 1913.]

Plates VII-X.

THROUGH the kindness of Messrs. Tom Iredale and W. R. B. Oliver, there has been sent me a small series of Cephalopods from the Kermadec Islands, the attempt to identify which has led to the preparation of this report, the material proving to be unusually interesting. The specimens were collected on Sunday Island by Messrs. Iredale, Oliver, and R. S. Bell in 1908 and

* To avoid delay it has been necessary to print this paper without having the proofs corrected by the author.—ED.

1910, but only one species, a littoral *Polypus*, was taken alive. The remaining species were only captured by reason of their being wave-bound on the various beaches, more particularly that of Denham Bay; but nearly all the specimens are nevertheless in a very fair state of preservation. In many instances I found the pallial chamber to be partially filled with small pebbles and coarse gravel. Except for this trifling circumstance, there is usually little to indicate that the animals were not taken alive, and most of the damage they have suffered appears to be chiefly traceable to the use of formalin as a preserving medium.

The twenty-four specimens examined represent nine species. These are referable to eight genera, only *Polypus* being represented by more than one type. Four species and one genus appear to be new to the literature. The species which is the type of the new genus has proven to be of so remarkable a character that under the name *Nematolampas regalis* a brief account of it has already been published elsewhere (Berry, 1913). Another of the new forms is an *Abralia* which enables us to throw a little new light upon the value and interpretation of several of the characters commonly depended on as important indices in the classification of the group. One of the new *Polypi* is also of more than ordinary interest. So that in spite of its small size this collection is all in all one of the most noteworthy which it has been my good fortune to have for study.

So far as I can ascertain, no one has recorded any Cephalopods from the Kermadecs in any of the literature, although the "Challenger" Expedition (Hoyle, 1886) obtained *Moschites verrucosa*, *Cirrotheuthis meangensis*, and the curious *Amphitretus pelagicus* from very deep water in their immediate vicinity.

The notes here offered give reasons for considering the relationships of the fauna to lie rather with that of the New Zealand archipelago than with those of either the Tonga or Fiji groups, but the evidence is not so conclusive but that future investigations may indicate quite differently.

Fam. ARGONAUTIDAE Cantraine, 1840.

Genus ARGONAUTA Linné, 1758.

Argonauta sp.

There are two specimens of an *Argonauta* in the collection (S.S.B. 403), but I am quite uncertain regarding their identification, since, though both are females, neither is accompanied by its characteristic "shell," upon which single feature most of the specific distinctions relied upon in this group have been based. The entire genus is in need of a careful revision upon the basis of a close comparative study of the animals of both sexes. One of the present specimens proved to contain the well-preserved hectocotylus of a male within the pallial chamber above the left gill. This organ is so peculiar in some of its characters, and has been described in so few species, that a brief account of it will be added below.

Unfortunately, *A. böttgeri* is the only other species with which I have been able to compare the present form. The latter (*i.e.*, the Kermadec form) is a considerably larger species; the body is shorter, and is more full and ovate, lacking any conspicuous humps or torsions.

The hectocotylus is an elongate, slightly curved, firm, and fleshy organ of a length of about 35 mm.; width, 4-5 mm.; distal 5 mm. sharply recurved and connected with the proximad portion of the arm by a very

delicate transparent web. This recurved portion terminates distally in a long filament, which in the present specimen appears coiled up within an elongate semi-transparent sac, which occupies almost the entire outward portion of the hectocotylus. This sac has an opening towards its distal end, through which the filament passes to its connection with the arm proper; beyond this point the skin of the sac is continuous with the above-mentioned web. The delicate skin which forms the outer wall of the sac contains numerous dark chromatophores. The inner face of the arm is considerably wider than the remaining portion, much flattened, and bears 2 ultra-marginal series of crowded suckers, about 36 in each row; these are largest from about the 10th to the 15th pairs, thence diminishing regularly in size nearly or quite to the tip of the arm proper, where they are very small. The suckers have a short columnar form with slit-like apertures; all are closely connected by a membrane.

The more important measurements of both specimens are appended below. The smaller was the one containing the hectocotylus.

	<i>Measurements.</i>			Type.	Cotype.
				mm.	mm.
Total length	120	135
Length of body, dorsal	38	40
Tip of body to base of dorsal arms	42	44
Width of body	26	27
Width of neck (nuchal commissure)	18	17
Width across eyes	24	23
Length of funnel	29	26
Length of right dorsal arm (excluding velum)	56	70
Length of left dorsal arm (excluding velum)	69	60
Length of right second arm	84	87
Length of left second arm	80+	88
Length of right third arm	80	78
Length of left third arm	78	78
Length of right ventral arm	70	77
Length of left ventral arm	68	66
Length of umbrella between dorsal arms	18	15
Length of umbrella between ventral arms	12	11

These specimens were collected on Denham Bay beach, Sunday Island, by R. S. Bell.

Fam. POLYPODIDAE Hoyle, 1904.

Genus POLYPUS Schneider, 1784.

Polypus oliveri n. sp.

Body of firm consistency, plump, of rounded pyriform outline, broadest posteriorly, a well-marked longitudinal groove in the median line below. Pallial aperture of moderate width, extending almost exactly half-way between the funnel and eye on either side.

Head short, considerably narrower than the body, from which it is rather poorly delimited by a slight constriction. Eyes elevated, conspicuous, with small puckered openings. Funnel short, bluntly conical, its apex extending about half-way to the margin of the umbrella between the ventral arms.

Arms quite short, on an average somewhat more than four times as long as the body, or three times as long as the head and body taken

together; in length subequal, but the lateral pairs slightly exceeding the dorsal and ventral; stout, conical, little attenuate, rapidly tapering; the first 4 suckers on each arm in a single row, the remainder crowded and in 2 series which are well separated from one another; the suckers attain their maximum in size and crowding at a point just below where the margin of the umbrella joins the arm. Umbrella thick, short, of slightly greater extent dorsally than ventrally, and laterally than dorsally, where it extends for less than a quarter the length of the arms; it is continued as a fleshy fold along the outer surfaces of all the arms.

Surface nearly smooth below, but ornamented above by numerous low, rough, conical tubercles, the skin between which may be either (1) smooth, or (2) finely papillose with smaller tubercles which are similar to the more persistent larger ones except in size. The finer wrinklings and papillations extend over the entire outer and lateral surfaces of the arms, and on the inner surface of the umbrella as well. There are no conspicuous supracocular cirri, but the eye-opening appears to be surrounded by a circle of 5 or 6 low and indistinct papillae.

Colour a dark slate, shading somewhat lighter below. The inner surfaces of the suckers are a conspicuous light brown, sometimes shading to cream.

Two females of this species are in the collection, probably neither of them full grown. The smaller is rather the better preserved, and has been selected as the type (S.S.B. 405). Both were taken alive among the rocks by W. R. B. Oliver in 1908.

	<i>Measurements.</i>			Type.	Cotype.
				mm.	mm.
Total length	175	190
Length of body, dorsal	30	27
Tip of body to base of dorsal arms	45	40
Width of body	31	37
Width of neck	23	26
Width across eyes	23	24
Length of funnel	16	17
Length of right dorsal arm	120	133
Length of left dorsal arm	105	130
Length of right second arm	130	144
Length of left second arm	125	144
Length of right third arm	132	142
Length of left third arm	127	140
Length of right ventral arm	120	135
Length of left ventral arm	124	135
Length of umbrella between dorsal arms	25	32
Length of umbrella between ventral arms	19	27

P. oliveri is one of the rough-skinned *Polypi*, perhaps allied to *P. vitiensis* Hoyle (1886, p. 84), which I have not seen, but the description of which certainly differs in a good many particulars. The present species does not seem to offer any very striking characters of its own, but a careful search through all the available literature has failed to reveal any other named form with which its union seems to me justifiable. To *P. kermadecensis*, the other member of the genus from the Kermadecs, it is in no degree related.

The species is named for Mr. W. R. B. Oliver.



Polypus sp. (young).

A young *Polypus* in the collection (S.S.B. 406) has an elongate cylindrical pointed body, a large head with very large prominent eyes, a short umbrella much better developed ventrally than dorsally, and fairly short subequal arms, the dorsal pair being a little the shortest. The colour is brown, coarsely mottled above with dark grey. The chromatophores are numerous and minute, except a number of larger ones scattered with some regularity over the lower surface of the mantle and a double series of distant chromatophores along the outer aspect of each of the four ventral arms. There are no cirri, but the dorsum is covered with numerous low indistinct papillations which soon become obsolete ventrally.

Though impossible of certain statement, it seems not unlikely that this specimen represents a young stage of *P. oliveri*.

Polypus (*Pinnoctopus* ?) *kermadecensis* n. sp. Plates VII and VIII.

Body narrow and elongate for a *Polypus*, the width contained about twice in the length; compressed dorso-ventrally; entire lateral periphery bordered by a thin but conspicuous fold of skin which commences close to or at the mantle-margin just above the funnel, thence gradually widens posteriorly till it reaches a maximum width of nearly a centimetre (half the width of the body) just before rounding the posterior extremity of the body. Except for an abrupt notch-like indentation in the middle behind, the margin of this membrane is entire all round. Mantle-opening ample.

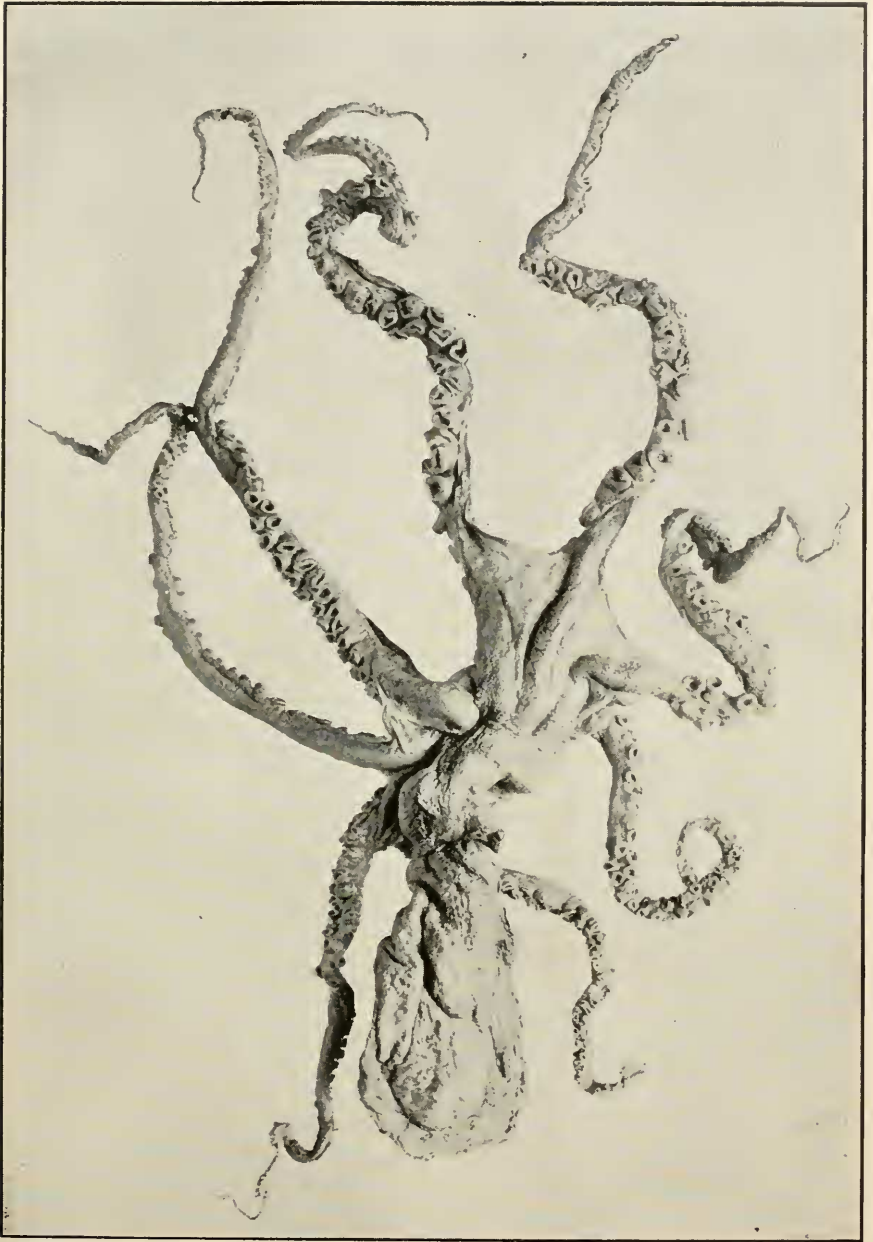
Head small, long and narrow, being mainly composed of the large prominent protruding eyes; a decided constriction separates it from the body. The eyes are very posterior in position, the anterior portion of the head having the appearance of a stout stalk connecting them with the region of the arms. Funnel long and thin-walled, the anterior portion free for a little more than a third of its length; apex not quite reaching past the eyes. Funnel organ in the present material not sufficiently well preserved for description.

Arms exceedingly long, slender, and attenuate; very unequal, their order of relative length 1, 2, 3 = 4. The dorsal arms, which are not only much longer but in every way more robust than those of the remaining pairs, are fully four times as long as the body. Suckers for the most part small, largest just proximad from the middle of each arm, a region where they attain a conspicuous maximum in the case of the dorsal pair; elevated, and everywhere in 2 rather compressed but little crowded rows, save the 4 at the extreme base of each arm which appear in single file. The 8 basalmost suckers (one on each arm) form a circlet about the mouth; they are very minute. Umbrella thin, transparent; best developed dorsally, where it extends between the arms of the dorsal pair for about a sixth of their length; ventrally it is scarcely more than half as long.

Hectocotylus unknown.

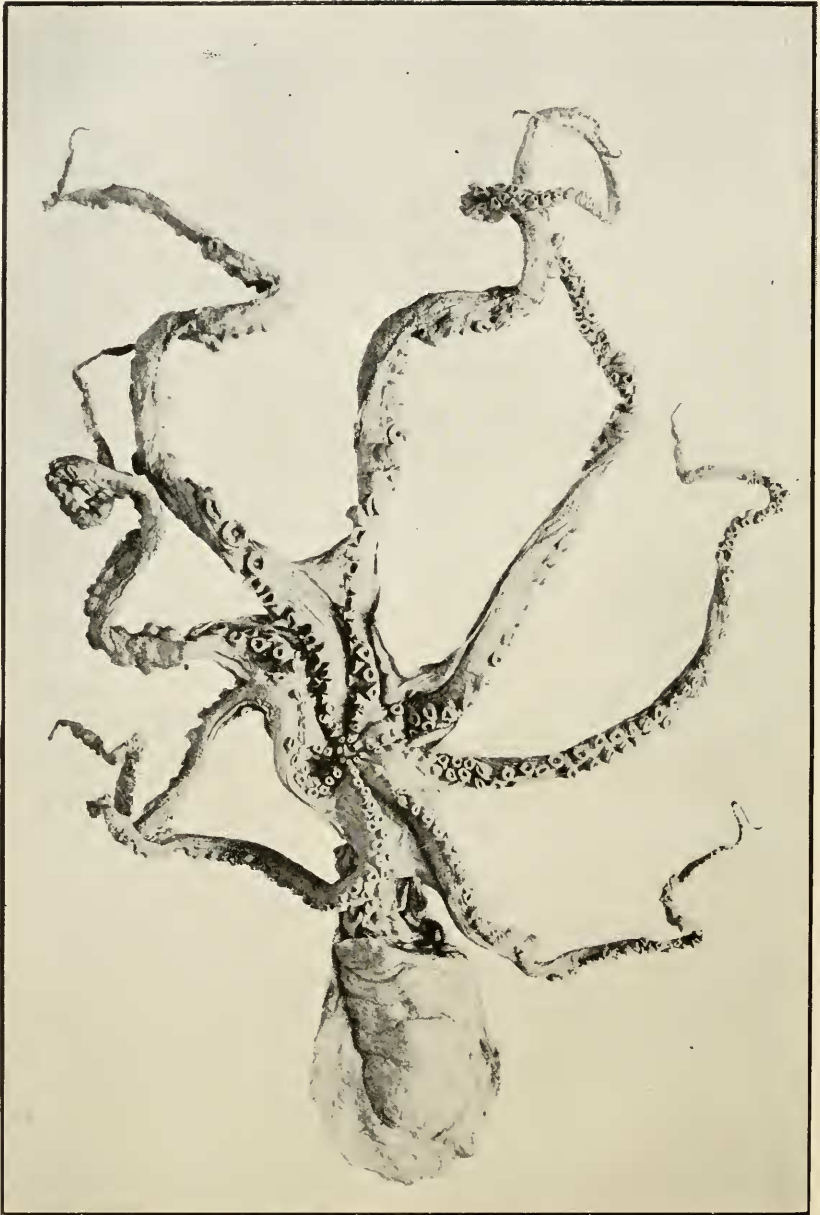
Surface everywhere nearly smooth. A few soft tubercles are to be made out just back of and above the eyes, while other scarcely distinguishable papillae are scattered here and there over the dorsum.

Colour a dull grey-brown, more or less mottled and streaked with slate. No ocellations or other definite colour-pattern of any sort is to be made out from the preserved material.



POLYPUS KERMADECENSIS, ♀.

Dorsal View.



POLYPUS KERMADECENSIS, ♀.

Ventral View.

<i>Measurements.</i>		mm.
Total length	.. .. .	250
Dorsal length of mantle, excluding web	.. .. .	43
Dorsal length of mantle, including web	.. .. .	50
Width of mantle, excluding web	.. .. .	20
Maximum width of web	.. .. .	9
Width of neck	.. .. .	10
Width of head	.. .. .	17
Length of funnel	.. .. .	18
Length of right dorsal arm	.. .. .	172
Length of left dorsal arm	.. .. .	181
Length of right second arm	.. .. .	151
Length of left second arm	.. .. .	150
Length of right third arm	.. .. .	114
Length of left third arm	.. .. .	127
Length of right ventral arm	.. .. .	91 +
Length of left ventral arm	.. .. .	127
Length of umbrella between dorsal arms	.. .. .	28
Length of umbrella between ventral arms	.. .. .	18

The only specimen seen is a small female (S.S.B. 399). Nevertheless, it presents so remarkable a combination of characters that there seems little risk in describing it as new. It necessarily recalls the *Pinnocotopus cordiformis* (Quoy and Gaimard) of New Zealand, but in that species the body is said to be tuberculated, and the arms are of nearly equal length. Moreover, the Kermadec specimen possesses no trace of the conspicuous blue lunulations along the arms as described for *P. cordiformis*—in fact, seems to have very little in common with the latter species save the remarkable development of the peripheral fold. In the smooth elongate body and predominating dorsal arms it approaches very closely the condition found in *P. macropus* (Risso), and this may prove something more than a mere coincidence.

Polypus sp. (young).

Two very juvenile *Polypi* in the collection (S.B.B. 404) may possibly represent young stages of *P. kermadecensis*. They are characterized by their very slender arms, and elongate light-coloured body terminating posteriorly in a sort of papilla, thus strongly recalling young specimens of *P. macropus* and perhaps *P. ornatus* of similar size. They lack the peripheral fold.

Fam. ONYCHOTEUTHIDAE Gray, 1849.

Genus ONYCHOTEUTHIS Lichtenstein, 1818.

Onychoteuthis banksii (Leach, 1817) Férussac, 1826.

Loligo banksii Leach, 1817, p. 141. *Onychoteuthis banksii* Férussac
in d'Orbigny, 1826. p. 151.

The collection contains one adult and five immature specimens of this widely distributed species (S.S.B. 401). The right tentacle-club of the largest specimen has 10 hooks in the dorsal row and 11 in the smaller ventral row, the basalmost hook in this row being conspicuously larger than the others. There are 8 suckers and 7 pads in the fixing-apparatus. The left tentacle-club of the second largest specimen has 11 hooks in the dorsal row, 10 hooks in the ventral row, and 9 suckers and 5 pads in the fixing-apparatus. The other tentacle-club in each case is missing.

Fam. LYCOTEUTHIDAE n. n.

Thaumtolampadidae Chun, 1903, p. 68. *Onychoteuthidae* subfam.
Lycoteuthinae Pfeffer, 1908, p. 294.

Genus NEMATOLAMPAS Berry, 1913.

Nematolampas Berry, 1913, p. 208.

A group allied to *Lycoteuthis* Pfeffer, 1900 (*Thaumtolampas* Chun, 1903), but with photogenic organs near the tips of the four dorsal arms and along the entire length of the third pair, which are highly modified, their tips being continued as very long and slender filaments devoid of suckers. Of the 5 subocular organs the central organ is conspicuously the largest. There is a pair of photogenic organs at the posterior extremity of the body, situated one on either side just under the fins. As in *Lycoteuthis*, there are 8 intrapallial photophores and 2 others of simple structure in the stalk of each tentacle.

Type.—The following species.

Nematolampas regalis Berry, 1913. Plate IX, figs. 1 and 2.

Nematolampas regalis Berry, 1913, p. 208, fig. 1.

Body small, loliginiform; the mantle thick and fleshy, compressed above and below; outline cylindro-conic, widest and very slightly flaring anteriorly, tapering more or less gradually to the fins, thence more rapidly to the posterior extremity, which is rounded and conspicuously swollen on either side, due to the presence of a pair of large heavily pigmented photogenic organs, which have much the appearance of small eyes; each organ is embedded in a small swelling of tissue snugly lodged in the angle between

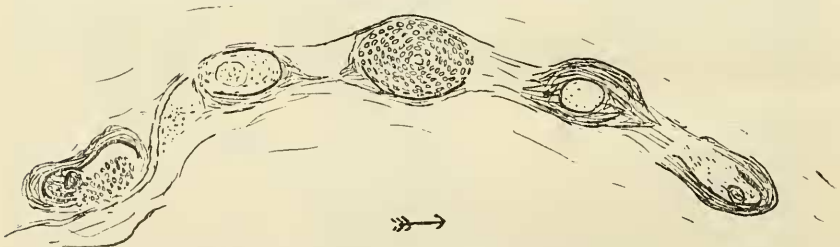


FIG. 1.—*Nematolampas regalis*: Subocular photophores from right eye of cotype. Frechand sketch from mount in balsam.

the fin and mantle, but so loosely adherent that it becomes readily dislodged after the fins have been loosened. Anterior mantle-margin with only a very slight angle dorsally, and a somewhat less obscure angle on either side of the funnel. Fins relatively very large, their combined width being about equal to the length of the body, though they are not quite half so long; anterior margins very thin, only slightly arcuate, and with a conspicuous notch next the body; posterior margins thicker and nearly straight, the outline of each fin thus forming an elongate (nearly) isosceles triangle, of which the lateral angle of the fin forms the apex. The fins are practically continuous with one another in the median line, at least posteriorly, and are very insecurely attached to the body.

Head relatively large, short, rounded, flattened above, somewhat excavated below. Eyes large and prominent. Ocular apertures large, with a slit-like sinus in front. Bordering the ventral periphery of each eyeball is a conspicuous series of 5 reddish bead-like photogenic organs. Of



Fig. 1. Dorsal View.



Fig. 2. Ventral View

NEMATOLAMPAS REGALIS

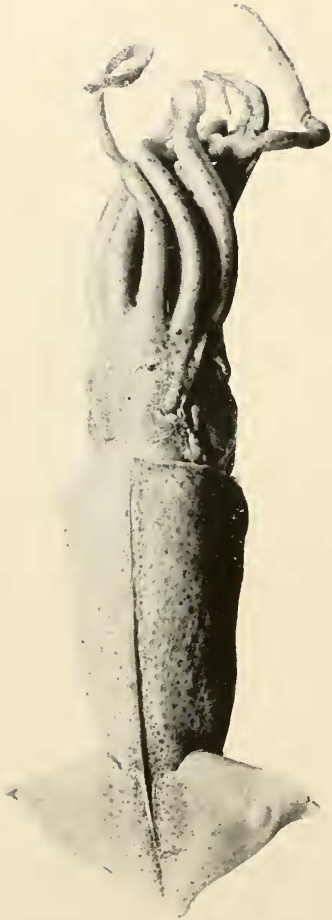


Fig. 1. Dorsal View.



Fig. 2. Ventral View.

ABRALIA ASTROLINEATA.

these the central one is distinctly the largest, the anterior terminal one the smallest. To the naked eye the central organ appears to be nearly circular in outline, the organs on each side of it more oval, and the terminal organs quite elongate, but when the entire series is removed and mounted in balsam their outline as seen under a low-power lens is more as shown in the accompanying diagram (fig. 1). The large central organ is so conspicuous that it is visible through the outer integument even in preserved specimens. The funnel is short, compressed, and bluntly conical. Locking cartilages simple, comprising a slightly curved cartilaginous groove with raised margins on either side of the base of the funnel, and a very long and narrow ridge on the inner surface of the mantle, the ridge being about half again as long as the groove.

Arms very unequal in length, their relative order 3, 2, 4, 1, or perhaps 3, 2 = 4, 1. Dorsal pair notably the shortest and more slender than the others; not keeled except for a faint carination along their distal portions; each bears a single small heavily pigmented photogenic organ in the tissues of the outer portion of the arm, near the tip. Second-arm pair similar to the first, but larger and with a somewhat better-developed keel distally; each possesses a photogenic organ a little larger than



FIG. 2.

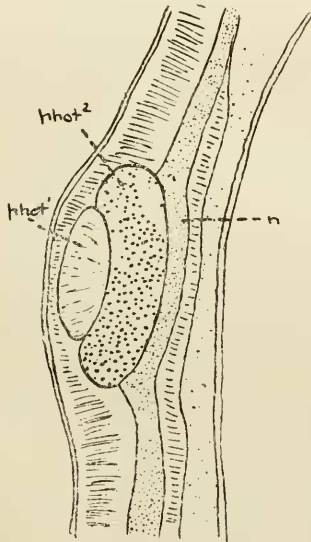


FIG. 4.

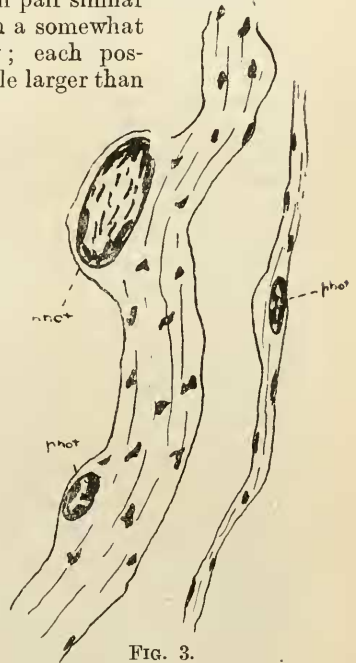


FIG. 3.

FIG. 2.—*Nematolampas regalis*: Right third arm of type, showing terminal filament and photogenic organs, the latter represented as small black dots.

FIG. 3.—*Nematolampas regalis*: Portions of terminal filament of right third arm of type, showing photogenic organs (the small dots in this drawing are chromatophores). Greatly enlarged freehand sketch from mount in balsam.

FIG. 4.—*Nematolampas regalis*: Portion of stalk of right tenacle of type, showing the large distal photogenic organ. Optical section from mount in balsam.

those of the dorsal arms, but otherwise similar. Third-arm pair stouter than any of the others and much the longest, terminating distally in an exceedingly slender beaded filament (fig. 2), which when straightened out is considerably longer than the entire remaining portion of the animal and is devoid of

suckers, though the arm proper is normal in this respect. The entire arm bears a succession of small photogenic organs scattered at various intervals along its outer margin, and similar in general appearance (though many of them are larger) to those near the tips of the first and second arms. On the filament these appear as swellings or tubercles often half again as large in diameter as the filament-stalk itself (fig. 3), but on the basal portion of the arm they become rather deeply embedded, and are not easily seen except by transmitted light. The basal portion, or arm proper, bears a heavy keel along its entire outer aspect, and traceable almost as far as the margin of the eyelid. Including those borne on its terminal filament, the better-preserved arm of this pair carries a total of 31 photophores, of which 4 are in the keel. The ventral arms bear the usual fleshy fold along their outer margins, which is broadened at the base to form a sheath for the tentacle; they do not appear to possess photophores. Suckers minute, in 2 regularly alternating series on all the arms; 16 to 18 pairs are to be counted on the right third arm of one specimen, and 21 pairs on the right ventral arm. The sucker-bearing face of each arm has a delicate trabeculated membrane along either margin.

Tentacles stout; thick and fleshy at the base, thence tapering gradually to the club; laterally compressed; inner surface flattened. A very slight swelling is sometimes visible in the stalk a few millimetres from the base, which, when mounted in xylol or balsam so that it can be examined by transmitted light, is seen to mark the position of a small internal organ which is undoubtedly photogenic. A somewhat larger swelling, rendered more conspicuous by a thick aggregation of chromatophores on its outer margin, occurs a few millimetres proximad from the club. When cleared and mounted in balsam this is seen to mark the position of a much larger double photophore, embedded in the tissues just beneath the patch of chromatophores. In optical section (fig. 4) the organ shows an outer radially striate body (lenticular in longitudinal section) closely appressed within the concave surface of a much larger body, shaped like a shallow oval saucer (bean-shaped in longitudinal section). Both structures lie between the muscular layers of the tentacle-stalk and the central nerve-cord, each of which suffers a corresponding crowding and distortion. Tentacle-club little or not at all expanded; it is provided with a marginal web and armed with 4 rows of small suckers with toothed horny rings. I have been unable to make out the fixing-apparatus with sufficient clearness for description.

In addition to the numerous photogenic organs already noted, there are 8 others which are intrapallial, and therefore only visible in preserved specimens upon opening the mantle-chamber. The most anterior of these are the anal, a pair of small round greyish organs situated one on either side of the rectum just below the base of the funnel. A little to the rear of the middle of the visceral mass is a conspicuous half-circlet of 5 organs, the median one pale in colour, oval in outline, flattened, and unpaired; the two neighbouring organs in close juxtaposition to the central one, very large, likewise flattened and pale in colour. The terminal organs of the series are somewhat distant from the other three, one at the base of each gill, and have the appearance of small flattened tubercles set in pigmented cups. In the median plane of the body, considerably behind the centre of the fins, is a single large flat lozenge-shaped organ of a pale colour, in contact with which the tissues of the mantle are modified to form a conspicuous lens-shaped thickening similar to that described by Chun for *Thaumato-*
lampas.

Colour of specimens preserved in formalin a brownish buff dotted with numerous slate-coloured chromatophores which are very much more numerous dorsally than ventrally.

There are two specimens of this species in the collection, one of them well preserved (S.S.B. 409), the other fragmentary (S.S.B. 410). The former, which I have taken as the type, has furnished the greater part of the foregoing description, but the account of the subocular and intrapallial photogenic organs was drawn up from the second specimen.

Both specimens were picked up on the beach at Sunday Island in 1910 by R. S. Bell.

<i>Measurements.</i>			Type.	Cotype.
			mm.	mm.
Length of body, dorsal	..	..	32	26.5
Tip of body to base of dorsal arms	..	..	41	33
Length of fins, extreme	..	..	15	10.5
Width of body	..	..	11	9
Width across fins	..	..	32	22
Width across eyes	..	..	11	9
Length of head	..	..	8	7.5
Length of funnel	..	..	..	6
Length of right dorsal arm	..	..	14	9
Length of left dorsal arm	..	..	14	12
Length of right second arm	..	..	17	13
Length of left second arm	..	..	18	14
Length of right third arm	..	..	75+	18+
Length of left third arm	..	..	50+	16+
Length of right ventral arm	..	..	17	12
Length of left ventral arm	..	..	17	12
Length of right tentacle	..	..	28	..
Length of left tentacle	..	..	25	..
Length of tentacle-club	..	..	8	..

This amazing little squid presents a very remarkable combination of characters, some of its features being, so far as I know, unique in the entire class *Cephalopoda*. Indeed, only two of all the described forms are even sufficiently similar for consideration in the same connection. These are the wonderful *Thaumtolampas diadema* of Chun (*Enoploteuthis diadema* Chun, 1900, p. 532, fig.: *Lycoteuthis diadema* Chun, 1903, p. 569, figs.: *Thaumtolampas diadema* Chun, 1903A, p. 67, &c.; 1910, p. 59, pl. 1-4) and the perhaps identical *Lycoteuthis jattai* of Pfeffer (1900, p. 161: *L. diadema* Pfeffer, 1908, p. 294; 1912, p. 113). *Enoploteuthis diadema* Chun, 1900, has precedence over *Lycoteuthis jattai* Pfeffer, 1900; whereas *Lycoteuthis* is in its turn prior to *Thaumtolampas* Chun, 1903. Pfeffer accordingly unites both forms under the name *Lycoteuthis diadema* (Chun); but, while in view of the evidence he gives there seems little doubt that the two genera are identical, it may be that the actual specific names will not prove to be synonyms. However that may be, *Lycoteuthis* is undoubtedly a very near ally of the form now before us, and the relation between the two is a most interesting one. Leaving out of consideration the extraordinary development of the third-arm pair, we find that, except in a few and relatively inconsequential details, no very special differences*

* Such differences appear in—(1) the order of length of the arms (2, 4, 3, 1 in *L. diadema*); (2) the fact that the central photophore of the subocular series is distinctly the largest in *Nematolampas*, whereas Pfeffer's figure of *Lycoteuthis* (1912, pl. 14, fig. 9) shows the two terminal organs as the largest; (3) the broader fins of the Kermadec species; &c.

obtain between *Nematolampas* and the specimens of *Lycoteuthis* until we come to a study of the distribution of the luminous organs. Even here we find that each and every such organ described by Chun for *L. diadema* finds its exact homologue in *Nematolampas*, but, continuing further, it appears that the Kermadec species possesses another entire battery of these "living lights" in addition. The comparison is well brought out in the following table:—

Position of Photophores.	<i>Lycoteuthis diadema.</i>	<i>Nematolampas regalis.</i>
Ventral periphery of eyeball (5 on each) ..	10	10
Tip of dorsal arms (1 on each) .. ..	..	2
Tip of dorso-lateral arms (1 on each) .. ..	..	2
Ventro-lateral arms (31+ on each) .. ..	..	62+
Tentacles (2 on each)	4	4
Within pallial chamber—		
Anal	2	2
Branchial	2	2
Abdominal	4	4
Posterior extremity of body .. ..	..	2
	22	90+

The complete homology of the complex intrapallial and tentacular photogenic systems of the two species, coupled with the fact that all the more important characters which differentiate *Nematolampas* (*i.e.*, not only the additional photophores, but the filamentous terminations of the third-arm pair) take the form of features, as it were, superadded to those already present in *Lycoteuthis*, at once suggests that in *Nematolampas* we have either a more advanced stage in the ontogeny of the older genus, or simply more perfect material. I do not believe that either hypothesis, however, is in accordance with all the facts. In the first place, the dimensions of the type of *L. diadema* as given by Chun exceed those of the smaller of the Kermadec specimens, and average only slightly less than those of the larger; in the second place, though the specimens before me are not at all of the same size, they do not differ in any essential particulars; and, in the third place, *L. diadema* was captured and observed in the living state by an investigator no less acute than Dr. Chun himself.

It will be noted from the above account that *Nematolampas regalis* possesses at least 90 definitely and symmetrically arranged photogenic organs, of which only 2 are unpaired, and it may be that there are yet others which have escaped my search, the opacity of the tissues in preserved material frequently rendering their detection exceedingly difficult. The 22 organs of *Lycoteuthis*, according to Chun, are constructed upon no less than ten *different principles*, and are adapted for the production of lights of several different colours and intensities. These ten types are all present in the species from the Kermadecs, with at least two more as well. As to the gorgeous appearance of this animal in life, we can only conjecture, although Chun's lively description of his species gives us a most tantalizing inkling of what we may expect. Cephalopods are bizarre creatures anyway, but no more astonishing member of the group than this has rewarded one of our collecting expeditions for a good many years.

Fam. ENOPLOTEUTHIDAE Pfeffer, 1900.

Genus ABRALIA Gray, 1849.

Abralia astrolineata n. sp. Plate X, figs. 1 and 2.

Mantle cylindro-conical, broadest anteriorly; tapering but slightly for about half its length, thence rapidly, and then more gradually again to a rather blunt point, the presence of 3 faint light-coloured swellings or tubercles (one median and very indistinct, the others lateral, slightly more conspicuous, and situated close up under the base of the fins) giving rise to a general swollen appearance just in front of the actual tip. Anterior mantle-margin with only a slight obtuse median angle dorsally, and somewhat more acute lateral angles below on either side of a shallow emargination under the funnel. Fins large, broadly triangular; about three-sevenths as long as the body, their combined width about three-fourths the length of the body; anterior margins slightly arcuate, with a conspicuous notch next the body; posterior margins slightly concave, and barely produced posteriorly to include the tip of the body.

Head squarish, flattened above excavated below. Ocular apertures very large, their margins with only a faint obtuse angle in front in place of the usual sinus. Funnel broadly triangular; swollen below; squarish at the extremity.

Arms about two-thirds as long as the body; unequal, the order of relative length 4, 2, 3, 1; dorsal arms a little more slender than the others, rounded at the base, but with traces of a keel distally; second-arm pair angular and weakly keeled, third pair more so; ventral arms with a broad keel along their outer margins forming the usual sheath at the base for the tentacles; "swimming membranes" present on all the arms, the ventral membrane of the third pair being especially well developed. Each arm is equipped with 2 rows of small hooks, but on all, even the ventral pair, these are succeeded by true suckers on the distal portions, though the latter are notably fewer on the ventral arms than on the others.

Tentacles long and rather slender; club little expanded, and armed over the distal half of its inner face with 4 rows of very minute suckers, replaced proximally by a single row of sharp and slender hooks, with 2 series of wide-mouthed suckers opposite. The left tentacle-club of the present specimen (which is better preserved than its mate) shows the rows of hooks to comprise 1 small proximal hook succeeded by 4 larger ones, while the suckers of the outermost series are notably larger than those corresponding in the inner row. The carpal fixing-apparatus contains 5 small suckers, the proximal one excessively minute, and a probably similar group of pads, the exact number of which I have been unable to determine. On the right tentacle there appear to be but 4 suckers in the fixing-apparatus and only 4 hooks on the club. The horny rings on the largest tentacular suckers are armed with some 27-29 round-pointed teeth.

The photogenic organs are very numerous, and their somewhat unusual distribution may be briefly outlined as follows, according to the regions of the body which they occupy.

A. *The Mantle.*

1. *Ventral Aspect.*—Here the arrangement of the numerous luminous organs shows an essential bilateral symmetry throughout. The entire medio-ventral line of the body is marked by a narrow clear space, slightly broadening posteriorly just before reaching the tip of the body, and devoid of photophores. Defining the clear strip on either side are 2 conspicuous

multiple bands of round bluish photophores (4 bands in all), of which the inner pair are the most regular, persist farthest posteriorly, and are the broader, including a central series of comparatively large distant organs flanked on each side by a more numerous series of smaller and darker ones. Lateral to these 4 bands on each side is a somewhat irregular single series of small organs, with traces of at least 2 similar rows beyond this. In all these lateral series the photophores exhibit a curious tendency to lie in longitudinal groups of three, the median organ of which is in each case the largest. The differentiation of the organs into those of a larger and a smaller type is evident as in other species, but not conspicuous, and there are many of various intermediate conditions.

2. *Dorsal Aspect*.—A single series of very minute distant organs extends along the dorsum close to the gladius on either side. There are a few scattered organs, apparently traces of other longitudinal rows, here and there over the remainder of the dorsal surface.

B. *The Funnel.*

Four series (or, better, groups) of photophores similar to those of the mantle occur on the ventral aspect of the funnel. They are well separated, the two median groups being closer to one another than either is to its lateral neighbour.

C. *The Head and Arms.*

1. *Ventral Aspect*.—Here there are 3 conspicuous biserial to triserial bands of organs, of which the median is the broadest, at least posteriorly, where it bifurcates into 2 triangular groups; one of the larger type of organs occurs at the point of bifurcation and another in the centre of each group. Anteriorly the median band becomes single and again bifurcates, the 2 resulting series extending along the inner margin of each ventral arm not quite to its extremity. The lateral bands likewise extend along the ventral arms, running out their outer margins to the tips. Lateral to all these on each side is a single series of the organs; this series is interrupted by the clear area overlying the large subocular photophores, but thereafter continues along the outer edge of the membrane bordering the ventral arms, so that in all there are 3 rows of photogenic organs on each member of this arm pair. A circle of photophores borders the aperture of each eyelid, and there is a single series of some 4 or 5 of the organs on the outer angle of the basal portion of the third arms.

2. *Dorsal Aspect*.—I have been unable to detect the presence of photogenic organs on the dorsal surface of the head, or on any of the dorsal or dorso-lateral arms.

D. *The Tips of the Ventral Arms.*

A series of 3 very minute but heavily pigmented organs is to be made out at the tip of each ventral arm. They are not conspicuous, are too small to be designated even as "swellings," and would be apt to escape an unwary examination.

E. *Eyes.*

A longitudinal series of 5 large round bead-like organs is borne on the ventral periphery of each eyeball. They are of a dark-red colour, the centre paler and are very similar in size and appearance. The three central organs are so close together as to appear almost in contact, but each terminal organ is set off by a slight space.

Colour of the entire animal a brownish buff, dotted above with numerous scattered brownish chromatophores. On the dorsal aspect of the head the

latter are more numerous than anywhere else, and mostly gathered in 2 large, dark, and very conspicuous triangular patches, one over each eye. There are chromatophores on the ventral surface, but owing to their larger size and more definite arrangement the bluish slate-coloured photogenic organs are much more conspicuous. The keel of the gladius is very plainly evident through the dorsal integument as a sharp and prominent dark line. The buccal membrane is pale, its outer surface beautifully dotted with reddish-brown chromatophores.

The type and only specimen seen is a female (S.S.B. 408). It is a remarkably well-preserved beach specimen, collected by R. S. Bell in 1910.

<i>Measurements.</i>		mm.
Total length	.. .. .	90
Length of mantle, dorsal	.. .. .	34
Tip of body to base of dorsal arms	.. .. .	42
Extreme length of fins	.. .. .	15
Width of body	.. .. .	11
Width across fins	.. .. .	26
Width across eyes	.. .. .	11
Length of right dorsal arm	.. .. .	19
Length of left dorsal arm	.. .. .	19
Length of right second arm	.. .. .	22
Length of left second arm	.. .. .	22
Length of right third arm	.. .. .	20
Length of left third arm	.. .. .	20
Length of right ventral arm	.. .. .	24
Length of left ventral arm	.. .. .	23
Length of right tentacle	.. .. .	40
Length of left tentacle	.. .. .	48
Length of tentacle-club	.. .. .	7

In its general organization *A. astrolineata* represents a type so different from all other *Abralias* as to scarcely require any special comparison with any of them. Its most conspicuous distinctive feature is undoubtedly to be found in the beautiful banded arrangements of the photogenic organs on the ventral surface of the mantle, but an even more interesting feature appears in the structure of the ventral arms. These show a condition almost exactly intermediate between the highly modified ventral-arm tips of *Abraliopsis* and the normal state of affairs in *Abralia*, thus in large degree tending to break down in a most important particular the distinction between the two groups. While the ventral arms in this species bear true suckers at their extremities, differing from those of the other arms in no (apparent) essential particular save their smaller number, each bears at its very tip a series of 3 very minute heavily pigmented photophores, which, despite their poorer development, are very obviously homologous with the curious swollen terminal photophores of *Abraliopsis*. As in the latter genus also, there are but 3 rows of photogenic organs along the basal portion of the ventral arms, although the buccal membrane and tentacular armature are those of the usual *Abralia*. The reader has perhaps noticed that in a number of particulars *A. astrolineata* agrees very curiously with *A. astrodicta* of the Hawaiian Islands; but it has nevertheless a totally different aspect, and undoubtedly belongs to another group, the much larger fins and different distribution of the pallial photogenic organs being among the more obvious differences. The latter structures are also more numerous and much less conspicuously dimorphic than in *astrodicta*.

What may be the nature of the lateral swellings observed near the posterior tip of the body, and whether they may in any way be homologized with the photogenic organs which occupy an analogous position in *Nematolampas*, I have been unable to determine.

Genus ABRALIOPSIS Joubin, 1896.

? *Abraliopsis hoylei* (Pfeffer, 1884) Joubin, 1896.

Enoploteuthis hoylei Pfeffer, 1884, p. 17, fig. 22. *Abraliopsis hoylei* Joubin, 1896, p. 33, &c. *Abraliopsis hoylei* Hoyle, 1904, p. 36, pl. 1, fig. 3; pl. 8; pl. 10, figs. 1-10.

The single specimen sent me (S.S.B. 400) is perhaps not quite adult, so that I refer it to this species with considerable uncertainty, more especially since Pfeffer (1912, pp. 152, 160) has recently expressed the opinion that the Panamic specimens described by Hoyle represent a previously unnamed species which he designates as *A. affinis*.

The left tentacle-club of this specimen is missing, but the right club has 5 suckers and 5 pads in the fixing-apparatus, and 2 rows of hooks succeeded distally by the usual 4 rows of small suckers. The ventral row of hooks consists of 4 large hooks with a single very minute sucker proximal to them in the same row. The dorsal row contains a similar small proximal sucker, succeeded by 3 (+ one missing ?) small hooks.

The specimen was collected on one of the beaches by R. S. Bell in 1910.

Fam. OMMASTREPHIDAE Gill, 1871.

Genus STHENOTEUTHIS Verrill, 1880.

Sthenoteuthis bartramii (Lesueur, 1821) Verrill, 1880.

Loligo bartramii Lesueur, 1821, p. 90, pl. 7. *Sthenoteuthis bartramii* Verrill, 1880, p. 223.

Three specimens in the present collection (S.S.B. 407) serve to extend still further the wide area of ocean already known to be inhabited by this species. They were cast up on Denham Bay beach, and collected at various times during 1908 by Mr. T. Iredale.

Genus SYMPLECTOTEUTHIS Pfeffer, 1900.

Symplectoteuthis oualaniensis (Lesson, 1830) Pfeffer, 1900.

Loligo oualaniensis Lesson, 1830, p. 240, pl. 1, fig. 2. *Symplectoteuthis oualaniensis* Pfeffer, 1900, p. 180; 1912, p. 502, pl. 40, 41; pl. 42, figs. 1-4.

The three specimens here referred to the present species are all immature, the largest having a medio-dorsal mantle-length of only 44 mm.; but all show the characteristic adhesion of the mantle to the locking cartilages of the funnel on both sides (S.S.B. 402).

Collected on the beaches in 1910 by R. S. Bell.

LITERATURE CITED.

- Berry, S. S. 1913. "*Nematolampas*, a Remarkable New Cephalopod from the South Pacific." "Biological Bulletin," vol. 25, pp. 208-12, fig. 1.
 Chun, Carl. 1900. "Aus den Tiefen des Weltmeeres." Jena.
 ——— 1903. "Aus den Tiefen des Weltmeeres." Zweite Auflage, Jena.
 ——— 1903A. "Über Leuchtorgane und Augen von Tiefsee-Cephalopoden." Verhandl. Deutschen Zool. Gesellschaft, 1903, pp. 76-91; 14 text figures.

- Chun, Carl. 1910. "Die Cephalopoden." 1 Teil: *Oegopsida*. Wiss. Ergebn. deutsch. Tiefsee-Exped., "Valdivia," bd. 18, pp. 1-402; 2 plates and 32 figs. in text; atlas of 61 plates.
- Hoyle, William E. 1886. "Report on the *Cephalopoda* collected by H.M.S. 'Challenger' during the Years 1873-76." Voyage of the "Challenger," vol. 16, pt. 44, pp. i-vi, 1-246, pl. 1-33; 9 figs. in text.
- 1904. "Reports on the Dredging Operations off the West Coast of Central America . . . by the . . . 'Albatross.'" VI: Reports on the *Cephalopoda* Bull. Mus. Comp. Zool., vol. 43, pp. 1-71, pl. 1-12.
- Joubin Louis. 1896. "Observations sur divers Céphalopodes." Première Note: *Abraliopsis pfefferi* (nov. gen. et spec.). Bull. Soc. Sci. Ouest, Rennes, vol. 5, pp. 19-35; 10 text figures.
- Leach, William E. 1817. "Synopsis of the Orders, Families, and Genera of the Class *Cephalopoda*." Zool. Miscel., 3, Art. 30, pp. 137-41.
- Lesson, R. P. 1830. Mollusques, in "Voyage autour du monde, exécuté sur la corvette de S.M. 'La Coquille.' pendant les années 1822-25," &c. Zoologie, vol. 2, pt. 1. Paris.
- Lesueur, C. A. 1821. "Descriptions of Several New Species of Cuttlefish." "Journal Academy Natural Sciences, Philadelphia," vol. 2, pp. 86-101, plates.
- D'Orbigny, A. D. 1826. "Tableau méthodique de la classe des Céphalopodes." Annales Sci. Nat. (1), vol. 7, pp. 95-169.
- Pfeffer, Georg. 1884. "Die Cephalopoden des Hamburger Naturhistorischen Museums." Abhandl. Naturw. Vereins Hamburg, 8, 1, pp. 1-30, pl. 1-3.
- 1900. "Synopsis der eogopsiden Cephalopoden." Mitteil. Naturhist. Mus. Hamburg, 17, pp. 147-98.
- 1908. "Teuthologische Bemerkungen." Mitteil. Naturhist. Mus. Hamburg, 25, pp. 289-95.
- 1912. "Die Cephalopoden der Planktonexpedition. Zugleich eine monographische Übersicht der eogopsiden Cephalopoden." Ergebn. Planktonexpedition der Humboldt-Stiftung, bd. 2, pp. i-xxi, 1-815; atlas of 48 plates.
- Verrill, Addison E. 1880. "The Cephalopods of the North-eastern Coast of America." Part I: The Gigantic Squids (*Architeuthis*) and their Allies; with Observations on Similar Large Species from Foreign Localities. Trans. Connecticut Acad., vol. 5, pp. 177-257, pl. 13-25. December, 1879-March, 1880.

EXPLANATION OF PLATES.

PLATE VII.

Polypus kermadecensis, ♀: Dorsal view of type; about natural size.

PLATE VIII.

Polypus kermadecensis, ♀: Ventral view of type; about natural size.

PLATE IX.

Fig. 1.—*Nematolampas regalis*: Dorsal view of type; about twice natural size.

Fig. 2.—*Nematolampas regalis*: Ventral view of type; about twice natural size.

Because of their brittle condition, it proved impossible to straighten out the filamentous tips of the third-arm pair as completely as necessary to properly indicate their great length.

PLATE X.

Fig. 1.—*Abralia astrolineata*, ♀: Dorsal view of type; somewhat less than twice the natural size.

Fig. 2.—*Abralia astrolineata*, ♀: Ventral view of type; same scale as preceding.